

Message

From: Kesler, Karen [Kesler.Karen@epa.gov]
Sent: 10/7/2020 12:50:03 PM
To: Healey, John [healey.john@epa.gov]; Sengco, Mario [Sengco.Mario@epa.gov]
CC: Anderson, Danielle [Anderson.Danielle@epa.gov]
Subject: RE: A couple of questions re: North Dakota's hardness-dependent criteria

Hi Mario,

I am thinking along the same lines as John, and also want to qualify that I also never deal with the hardness-based criteria.

Looking through the materials online it seems like the CFs are used to translate from the total recoverable form of the metal to the dissolved form. Since ND says that the metals are in their total recoverable form ("For the aquatic life values for metals, the values refer to the total recoverable method for ambient metals analyses."), I am assuming they don't need the CF.

In terms of the 400 mg/L, I think the state probably needs minimal justification since this value is just being used as an example calculation and is not the actual criteria, the equations are the criteria. I think its good that they explain to their public the switch for transparency, but I don't think it is impacting the actual implementation of the criteria.

Let me know if you think this warrants following up further with someone in HECD (or if I should just text Lars on his vacation ☺).

Thanks,
Karen

Karen Kesler, PhD
Office of Science and Technology
U.S. Environmental Protection Agency
Washington, DC
202-564-4612

From: Healey, John <healey.john@epa.gov>
Sent: Tuesday, October 6, 2020 6:45 PM
To: Sengco, Mario <Sengco.Mario@epa.gov>; Kesler, Karen <Kesler.Karen@epa.gov>
Cc: Anderson, Danielle <Anderson.Danielle@epa.gov>
Subject: RE: A couple of questions re: North Dakota's hardness-dependent criteria

Hi Mario,

Sorry for my delay here. Heather Goss would have been a good person to ask this question, as I have mainly been involved with human health criteria and tangentially involved with the aluminum criteria (which is site-specific, based on pH, total hardness and DOC).

My understanding of the hardness-dependent metals criteria is that freshwater conversion factors (for converting a metal criterion expressed as the *total recoverable fraction* in the water column to a criterion expressed as the *dissolved fraction* in the water column) are not necessary when calculating hardness-dependent criteria. I say this based on Appendix A and Appendix B to the National Recommended Water Quality Criteria (see: <https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table#a> toward bottom of the page). Appendix A includes conversion factors for metals which are *dissolved* (but not hardness dependent), whereas Appendix B does not include conversion factors for metals which are both *dissolved* and *hardness dependent*.

Note 5 on page 20 of the 2004 National Recommended Water Quality Criteria document, National Recommended Water Quality Criteria – EPA, says something similar – that dissolved metals are calculated in one of two ways, depending on whether or not they are hardness-dependent. Again the hardness-dependent metals don't seem to need a conversion factor.

5. Calculation of Dissolved Metals Criteria

The 304(a) criteria for metals, shown as dissolved metals, are calculated in one of two ways. For freshwater metals criteria that are hardness-dependent, the dissolved metal criteria were calculated using a hardness of 100 mg/l as CaCO₃ for illustrative purposes only. Saltwater and freshwater metals' criteria that are not hardness-dependent are calculated by multiplying the total recoverable criteria before rounding by the appropriate conversion factors. The final dissolved metals' criteria in the table are rounded to two significant figures. Information regarding the calculation of hardness dependent conversion factors are included in the footnotes.

I hope this is helpful (and more importantly, I hope it's accurate!). It's a good question from Holly.

John

From: Sengco, Mario <Sengco.Mario@epa.gov>
Sent: Tuesday, October 06, 2020 2:12 PM
To: Healey, John <healey.john@epa.gov>; Kesler, Karen <Kesler.Karen@epa.gov>
Cc: Anderson, Danielle <Anderson.Danielle@epa.gov>
Subject: FW: A couple of questions re: North Dakota's hardness-dependent criteria

Hi, folk

With Erica's absence, Danielle thought I could approach you with the request below from Holly in R8. I think the main one is her question on when to use of the conversion factors. Thanks.

On her second question regarding a justification for changing the hardness value, I think she is on the right track on providing their 20 year field record. Happy to pass on any other suggestions.

Thanks,

Mario

From: Wirick, Holiday <wirick.holiday@epa.gov>
Sent: Tuesday, October 06, 2020 1:44 PM
To: Sengco, Mario <Sengco.Mario@epa.gov>
Cc: Anderson, Danielle <Anderson.Danielle@epa.gov>
Subject: A couple of questions re: North Dakota's hardness-dependent criteria

Hi Mario and Danielle, I hope you are doing well!

One of my questions is must freshwater conversion factors be used when calculating hardness-dependent criteria?

Below is an excerpt of ND's WQC table from the state's proposed WQS revisions. The state proposes to revise the hardness dependent criteria from 100 mg/L to 400 mg/L to reflect the hardness of the state's waters. They have 20 years of lentic and lotic systems data to support the revision.

When I plugged in ND's criteria for the metals revised below in EPA's 304(a) metals calculator spreadsheet that Erica and you sent me, the criteria were lower (in some cases significantly) when using the freshwater conversion factors. I'm just not clear on when one must use the conversion factors.

My other question is what "justification," if any, does ND need to provide in its WQS when changing its hardness-dependent criteria from 100 mg/L to 400 mg/L? Should the state provide a description of background conditions citing the 20 years of data to support the revision?

Thanks so much for your help with these questions!

		Aquatic Life Value Classes I, IA, II, III		Human Health Value	
				Classes I, IA, II ²	Class III ³
7440-36-0	Antimony			5.6	640
7440-38-2	Arsenic ⁷	340 ⁹	150 ⁹	10 ⁷	
7440-41-7	Beryllium ⁴			4 ⁷	
7440-43-9	Cadmium	1.87.38 ^{6,15}	0.722.39 ^{6,15}	5 ⁷	
16065-83-1	Chromium (III)	1,805.611.70 ^{6,15}	86268.22 ^{6,15}	100(total) ⁷	
18540-29-9	Chromium (VI)	16	11	100(total) ⁷	
7440-50-8	Copper	14.051.68 ^{6,15,16}	9.330.50 ^{6,15,16}	1000	
7782-41-4	Fluoride			4,000 ⁷	
7439-92-1	Lead	81.82476.82 ⁶	3.218.58 ⁶	15 ⁷	
7439-97-6	Mercury	1.7	0.012 0.88	0.050	0.051
7440-02-0	Nickel	4701.516.92 ^{6,15}	52168.54 ^{6,15}	100 ⁷	4,200
7782-49-2	Selenium	20	5	50 ⁷	
7440-22-4	Silver	3.841.07 ^{6,15}			
7440-28-0	Thallium			0.24	0.47
7440-61-1	Uranium			30 ⁷	
7440-66-6	Zinc	120387.83 ^{6,15}	120387.82 ^{6,15}	7,400	26,000

Except for the aquatic life values for metals, the values given in this appendix refer to the total (dissolved plus suspended) amount of each substance. For the aquatic life values for metals, the values refer to the total recoverable method for ambient metals analyses.

- ² Based on two routes of exposure - ingestion of contaminated aquatic organisms and drinking water.
- ³ Based on one route of exposure - ingestion of contaminated aquatic organisms only.
- ⁴ Substance classified as a carcinogen, with the value based on an incremental risk of one additional instance of cancer in one million persons.
- ⁵ Chemicals which are not individually classified as carcinogens, but which are contained within a class of chemicals, with carcinogenicity as the basis for the criteria derivation for that class of chemicals; an individual carcinogenicity assessment for these chemicals is pending.
- ⁶ Hardness dependent criteria. Value given is an example only and is based on a CaCO₃ hardness of 100 ~~400~~ mg/l. Criteria for each case must be calculated using the following formula:

For the Criterion Maximum Concentration (CMC):

Cadmium CMC = $e^{0.9789[\ln(\text{hardness})] - 3.866}$ Chromium

(III) CMC = $e^{0.8190[\ln(\text{hardness})] + 3.7256}$

Copper CMC = $e^{0.9422[\ln(\text{hardness})] - 1.7000}$

Lead CMC = $e^{1.2730[\ln(\text{hardness})] - 1.4600}$

Nickel CMC = $e^{0.8460[\ln(\text{hardness})] - 2.2550}$

Silver CMC = $e^{1.7200[\ln(\text{hardness})] - 6.5900}$

Zinc CMC = $e^{0.8473[\ln(\text{hardness})] + 0.8840}$

CMC = Criterion Maximum Concentration (acute exposure value)

The threshold value at or below which there should be no unacceptable effects to freshwater aquatic organisms and

their uses if the one-hour concentration does not exceed that CMC value more than once every three years on the average.

For the Criterion Continuous Concentration (CCC):

Cadmium $CCC = e^{0.7977[\ln(\text{hardness})] - 3.909}$ Chromium

(III) $CCC = e^{0.8190[\ln(\text{hardness})] + 0.6848}$

Copper $CCC = e^{0.8545[\ln(\text{hardness})] - 1.7020}$

Lead $CCC = e^{1.2730[\ln(\text{hardness})] - 4.7050}$

Nickel $CCC = e^{0.8460[\ln(\text{hardness})] + 0.0584}$

Silver No CCC criterion for silver

Zinc $CCC = e^{0.8473[\ln(\text{hardness})] + 0.8840}$

CCC = Criterion Continuous Concentration (chronic exposure value)

The threshold value at or below which there should be no unacceptable effects to freshwater aquatic organisms and their uses if the four-day concentration does not exceed that CCC value more than once every three years on the average.

From: Wirick, Holiday <wirick.holiday@epa.gov>
Sent: Tuesday, October 6, 2020 11:10 AM
To: Sengco, Mario <Sengco.Mario@epa.gov>
Subject: Re: North Dakota's hardness-dependent criteria

Can I call you? Much easier and quicker to explain...

From: Sengco, Mario <Sengco.Mario@epa.gov>
Sent: Tuesday, October 6, 2020 11:06 AM
To: Wirick, Holiday <wirick.holiday@epa.gov>
Subject: RE: North Dakota's hardness-dependent criteria

Any pollutant or pollutants in particular?

From: Wirick, Holiday <wirick.holiday@epa.gov>
Sent: Tuesday, October 06, 2020 12:46 PM
To: Sengco, Mario <Sengco.Mario@epa.gov>
Subject: North Dakota's hardness-dependent criteria

Hi Mario, do you know who at HQ I can talk to about questions I have about hardness-dependent criteria?

Thanks,
Holly